MOTOR PROTECTION & CONTROL TECHNOLOGY

NewCode Relay

User Manual

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1. Abstract

The NewCode Relay is an ISO 9001:2000 compliant, local designed and manufactured three phase motor protection relay. It is a micro-controller based precision instrument with protection, advanced control features and starter logic. The relay is designed to cater for the low voltage motor protection market and is available in different current models. The current transformers, including the core balance current transformers are external.

The relay is fully configurable with the aid of front-end software or a man machine interface unit (MMI). Event records can also be downloaded with the aid of the MMI onto a memory stick for further analysis. All the settings are password protected. The relay has an on board database where time and date stamped records are kept. Two types of records are kept namely fault records (35 last faults) and event records (1400 events). In the case of event records, the user has limited access rights (read only). The front-end also has a data recorder and a spectrum analyzer which could be used to analyze motor performance and supplied power quality respectively. The spectrum analyzer can detect harmonics up to the 9^{th} harmonic on any of the three phase currents.

The relay detects earth leakage currents with the aid of the external core balance current-transformer and is configurable to operate in inverse definite minimum time (IDMT) or instantaneous definite time (IDT) mode.

A unique feature is added to the relay in the form of simulation. This function could be used for personnel training or relay functionality testing.

2. Specifications

2.1 Measurements

2.1.1 Current

- Three phase current
- Range: 5 Amp to 400 Amps (5A to 400A with additional external CTs)
- Models: 5, 10, 25, 50, 100, 200 and 400.
- Sensitivity range adjustment (MLC): 10% to 100% of full load current
- Dynamic range: 0% to 1000%
- Resolution: 500 steps (2% per step)

2.1.2 Voltage

- Range: 110V, 400V, 525V, 550V, 1050V, 3k3V, 6k6V and 11kV (from 3k3V upwards a step down transformer is used to step the voltage down to 110V).
- Range selection: Manual

2.1.2 Frequency

- Range: 30Hz to 100Hz
- Selectable during calibration: 50Hz or 60Hz (factory setting)

2.1.3 Power Factor

- Range: 0 to 100% (leading / lagging)

2.1.4 Power Dissipation

- Type: Apparent power (kVA) and Real power (kWatt);
- Derived from line voltage, phase current and power factor (where applicable)

2.1.5 Earth Leakage

- Range: 30mA to 3 Amps
- Trip time delay: Inverse Definite Minimum Time (IDMT) or Instantaneous Definite Time (IDT)

2.1.6 Real Time Clock

- 24 hour clock (Year, month, date, hours and minutes)
- Battery backup (5 days with 1 Farad super capacitor)
- Time and date stamping (Fault and event records)

2.1.7 Breaker Fault Clearance Time

- Measurement range: 10 ms to 1000ms
- Resolution: 10ms steps.

2.1.8 Insulation Resistance
- Measurement range: 1 to 199 kOhm
- Resolution: 1 kOhm steps.

2.2 Protection Features
(All resets are subjected to sufficient thermal capacity gain)

2.2.1 Over Current (Overload) Detection
- Curve class settings: 3 seconds to 40 seconds
- IEC 60255-8 specification
- Motor full load setting (MLC): 10% to 100%
- Reset: Manual or three automatic resets per hour (when selected)
- Reset threshold setting: Fixed at 70% thermal capacity or dynamic threshold adjustment determined over 10 last restarts.

2.2.2 Undercurrent (Minimum load) Detection
- Trip level adjustment: 10% to 100%
- Selection: Current level or power factor %
- Trip delay time: 1 to 10 seconds
- Start-up delay: 1 to 200 seconds (To facilitate pump priming)
- Reset time: Manual or 10 seconds to 6 hours (9 steps)
- Feature selectable

2.2.3 Unbalance Phase Currents Detection
- Trip level adjustment: 0 to 50%
- Trip delay time: 1 to 10 seconds
- Reset: Manual
- Feature selectable

2.2.4 Single Phasing (Phase lost) Detection
- Trip delay time: 1 second fixed
- Feature selectable
- Reset: Manual

2.2.5 Run-Stall Detection
- Stall current trip level adjustment: 110% to 300%
- Stall trip delay time: 0 to 120 seconds adjustable
- Feature selectable
- Reset: Manual

2.2.6 Vectorial-Stall Detection
- Trip: Static or decreasing power factor
- Trip delay: 33% of curve class setting.
- Reset: Manual
- Feature selectable

2.2.7 Starts per Hour Control
- Starts setting: 1 to 60 starts adjustable
- Consecutive starts: 1 to 3 starts per interval adjustable
- Reset: Automatic
- Feature selectable

2.2.8 Short Circuit Detection
- Articulated detection: If (I_{LOAD} > 950% and Power factor < 85%) or (I_{LOAD} > 300% and Power factor > 85%)
- Trip delay time: 1 second fixed
- Reset: Manual
- Feature selectable

2.2.9 Voltage Symmetry Detection
- Trip delay time: 10 seconds fixed
- Trip level adjustment: 70% to 99%
- Reset: Manual
- Feature selectable

2.2.10 Over Voltage Detection
- Trip delay time: 10 seconds fixed
- Trip level: Factory settings
- Reset: Manual
- Feature selectable

2.2.11 Under Voltage Detection
- Trip delay time: 10 seconds fixed
- Trip level: Factory settings
- Feature selectable
- Reset: Manual

2.2.12 High or Low Frequency Detection
- Trip delay time: 10 seconds fixed
- Trip level: Factory settings (45Hz to 55Hz)
- Reset: Manual
- Feature selectable

2.2.13 Voltage Phase Rotation

- No trip delay time
- Auto reset once fault is fixed
- Feature selectable (forward, reverse, none)

2.2.14 Insulation Failure Detection

- Detection: Only in static state (motor not running)
- Trip delay time: 1 second fixed
- Trip level: Resistance < 20 kOhm (fixed)
- Reset: Manual
- Feature selectable

2.2.15 Earth Leakage Detection (I_{EL} < 2A)

- Selection between Instantaneous Definite Time or Inverse Definite Minimum Time.
- Instantaneous Definite Time (100 ms ≥ t ≥ 1000 ms), (50 ms steps)
- Inverse Define Minimum Time (t ≥ 130 ms)
- Harmonic filtering (suitable for variable speed drives and soft starters)
- Trip level: Adjustable
- Reset: Manual
- Feature selectable

2.2.16 Earth Fault Detection (I_{EL} ≥2A)

- Harmonic filtering (suitable for variable speed drives and soft starters)
- Trip delay time: 1 second fixed
- Trip level: 2A fixed
- Reset: Manual
- Feature selectable

2.3 Control logic

2.3.1 Table of control outputs which can be mapped to any configurable input.

Input	Input	Input	Input	Input	Input
Zero ('0')	OverVolt_af	MinLoad_tf	RTClock	! LogicFunc_4	PLC_Input_2
One ('1')	UnderVolt_af	OverVolt_tf	! RTClock	LogicFunc_5	PLC_Input_3
InService	VoltSym_af	UnderVolt_tf	Counter_A	! LogicFunc_5	PLC_Input_4
VoltPresentF	HiFreq_af	VoltSym_tf	! Counter_A	LogicFunc_6	PLC_Input_5
OverCrnt_af	LoFreq_af	HiFreq_tf	Counter_B	! LogicFunc_6	PLC_Input_6
ShortCirc_af	IsoLockOut_af	LoFreq_tf	! Counter_B	DigFldInput_1	PLC_Input_7
RunStall_af	OverCrnt_tf	IsoLockOut_tf	LogicFunc_1	DigFldInput_2	PLC_Input_8
I_Unbal_af	ShortCirc_tf	PhaseRot_tf	! LogicFunc_1	DigFldInput_3	StarterOutp_1
I_Unbal_af	RunStall_tf	StartsPerHr_tf	LogicFunc_2	DigFldInput_4	StarterOutp_2
SinglePhs_af	I_Unbal_tf	Timer_A	! LogicFunc_2	DigFldInput_5	StarterOutp_3
EarthFault_af	SinglePhase_tf	! Timer_A	LogicFunc_3	DigFldInput_6	Restart
EarthLeak_af	EarthFault_tf	Timer_B	! LogicFunc_3	DigFldInput_7	FrozenContact
MinLoad_af	EarthLeak_tf	! Timer_B	LogicFunc_4	PLC_Input_1	TripFlag

2.3.2 Timers

- Timer A and Timer B
- Time setting: 0 to 50 minutes
- Start input: Configurable and level triggered (see 2.3.1)
- Reset / Inhibit input: Configurable and level triggered (see 2.3.1)

2.3.3 Real Time Clock (24 Hour)

- Start time: Hours and minutes configurable (see 2.3.1)
- Stop time: Hours and minutes configurable (see 2.3.1)

2.3.4 Counters

- Counter A and Counter B
- Count range: 0 to 250
- Count up input: Configurable and positive edge triggered (see 2.3.1)
- Count down input: Configurable and positive edge triggered (see 2.3.2)
- Reset / Inhibit input: Configurable and level triggered (see 2.3.1)
- Trip level setting: 1 to 250 counts

2.3.5 Logic function blocks

- Amount of function blocks: 6
- Three fully configurable inputs per logic function block (see 2.3.1).
- Sum of product or product of sums operation

2.3.6 Starter Logic

- Starter types:
  1. Direct On Line Starter
  2. Reversible Direct On Line Starter
  3. Star-Delta Starter
  4. Reversible Star-Delta Starter
  5. Dahlander Starter
  6. Reversible Dahlander Starter
  7. Soft Starter.
  8. Reversible Soft Starter
  9. Pulsed Output Direct On Line Starter
- Timers:
  1. Star Maximum Timer: 1 to 50sec
  2. Pre Start Warning Timer: 1 to 1200 sec (20 min)
  3. Execution Timer: 1 to 10 sec (Start executing)
  4. Feedback Timer: 50ms to 2000ms (Power dips)
  5. Unautherised Current Timer: 50ms to 2000ms
  6. Backspin Timer: 1 to 600 sec
  7. Transition Timer: 50ms to 5000ms (Change over from high speed to low speed)
- Selectable control sites: Local, remote, automatic (PLC control) and operator pannel

2.3.7 Relays

- Amount of Relays: 4
- Input: Configurable and level triggered (see 2.3.1)
- Slow relay 1 / Fast main trip relay selectable.
- Single set of potential free switch-over contacts

2.3.8 Pulse Generator

- Period: 1 to 250 min
- Duty cycle: 1 to 99%
- Control / Reset input

2.4 Statistical Data Capturing

- Running hours: Adjustable (0 to 65535 hours)
- Startup counter: Adjustable (0 to 65535)
- Trip counter: Adjustable (0 to 65535)
- Apparent power consumption metering (kV.A.h)
- Real power consumption metering (kWatt.h)

2.5 Trip Fault Recording

2.5.1 Database capacity: 35 last faults

2.5.2 Trip fault record content:

- Status: (Actual / simulated)
- Date: Year, month, date
- Time: Hour, minute
- Fault description
- Run hours
- Max trip current
- Minimum trip voltage
- Breaker fault clearance time.

2.6 Event Recording

2.6.1 Database capacity: 1400 last events

2.6.2 Event record content:

- Status: Actual, Simulated, Settings adjust, Power up, Calibration
- Date: Year, month, date
- Alarm flags
- Trip flags
- Run hours
- Max trip current
- Min trip voltage
- Breaker fault clearance time
- Digital field input states

2.7 Physical dimensions

- Size of foot print: 45 mm x 110 mm (DIN Rail mount / screw fix mount)
- Length: 110 mm
- Mass: 400 gram

2.8 Auxiliary power supply

- Voltage requirements: 110 Vac ± 10% or 230 Vac ± 10%
- Power requirements: 2,5 Watt

2.9 Operating environment

- Temperature: 0 – 50° Celsius
- Relative humidity: < 85

2.10 Networking (Communication)

2.10.1 Protocol:

- Profibus
- ModBus
- Canbus

3. Definitions and Terminology

Apparent power consumption	It is the amount of energy consumed. The power factor is not taken into account and is measured in kV.A.h
Apparent power dissipation	It is the product of voltage and current. The power is excluded and it is measured in kV.A
Breaker clearance time	It is the time taken by the breaker to clear the fault by interrupting the supply current to the motor. It can be seen as breaker response time and is useful information for breaker maintenance.
Consecutive starts	The amount of starts allowed during a time interval created by the starts per hour setting. (See also starts per hour)
Core balance current transformer	A current transformer used to detected possible current leakage to earth from one or more of the phases. (Earth leakage detection)
Digital field input	A signal generated by an external switch that could have an effect on the relay operation depending on the logic configuration.
Earth fault	It is leakage current above 2 amps and a severe form of an earth leakage condition. (See also core balance current transformer)
Earth leakage fault	It is leakage current up to 2 amps exceeding a trip level setting. (See also core balance current transformer)
Full load current	Current drawn by the motor at full load operation (90% to 100%)
Fundamental har-monic frequency	50Hz in South Africa and 60Hz elsewhere.
In Service state	Phase current above 10% of full load current
Isolation lockout / Insulation failure	The insulation resistance of the motor is measured while in a static (not in service) condition. If the resistance drops below 20 kOhm the relay will trip and will prevent a start.
Motor full load setting (MLC)	Adjustment of the relay current sensitivity. This is where the current level measurement is adjusted to read just below 100% when the motor operate at full load.
Non volatile memory	It is memory that will maintain data even when power is switched off for long periods. (see also volatile memory)
Over current (Overload)	Current level above 100% of full load current
Phase rotation	Normal phase rotation sequence is red, white and blue. Reverse rotation sequence is blue, white and red.
Power factor	It is die relationship between real power and apparent power Power factor % = ((V x I x CosØ) / (V x I)) x 100% Power factor = CosØ
Real power consumption	It is the amount of energy consumed. The power factor is taken into account and is measured in kWatt.h
Real power dissipation	It is the product of voltage and current. The power factor is included and it is measured kWatt.
Run-Stall	The motor went through the normal start procedure and the current level

	return to normal full level. If the rotor jam and the current rise above the stall setting (110% to 300%) it is recognized as a Run-Stall fault condition.
Running hours	The amount of time the motor was in an in-service state.
Starts per hour	Starts per hour define the time interval in which a restricted amount of starts are allowed. (See also consecutive starts)
Thermal capacity	It is a temperature related quantity expressed in percentage, which also takes in consideration the physical size, mass, construction, type of material etcetera used of the motor. It is normally indicated as capacity used unless otherwise stated.
Thermal curve class	It is the thermal curve derived from the unitary (one second) thermal curve. It is also the curve that goes through the points where maximum lock rotor current and maximum lock rotor time of the particular motor is specified.
Total Harmonic Distortion	Two standards are used: $THD = \frac{\sqrt{H_1^2 + H_2^2 + \dots H_n^2}}{H_1} \times 100\,\%$ $THD = \frac{\sqrt{H_1^2 + H_2^2 + \dots H_n^2}}{H_1 + H_2 + \dots H_n} \times 100\,\%$
Undercurrent (Minimum load)	Current level when motor run at no load condition.
Vectorial-Stall	It is detected during the startup procedure of the motor. A motor normally startup with a bad power factor and gradually improve it as full speed is approached. If no power factor improvement is detected for longer then 33% of the curve class time the motor is tripped to prevent thermal and mechanical damage.
Volatile memory	It is memory that will loose data during a power supply interruption. (see also non volatile memory)

4. Functional Description

The NewCode relay is controlled by a micro-controller. The three phase currents, voltages and earth leakage current are detected by current transformers, attenuator circuits and a core balance current transformer respectively. The current and voltage signals are conditioned by appropriate circuits and converted to 0 to 5 volt analogue signals. The analogue signals are digitized to 10 bit resolution.

The micro-controller has non volatile and volatile memory. The non volatile memory contains a boot loader program which is used to upload the operating software program of the relay. The uploading is done from a personal computer or laptop via the USB port. This feature also enables the user to do future software upgrades without factory assistance.

Front-end software is included that runs on MS Windows™. The USB port and infra red link (IrDA) are used as communication ports. The purpose of the front-end is to configure and select the required functionality of a specific application. The setup adjustments required at the installation phase will be discussed in the next chapter dealing with installation instructions.

The relay will monitor the parameters of the motor for the duration of auxiliary power supply. The auxiliary power supply is selectable (110Vac or 230Vac). When a trip condition occurs, the main trip relay will be activated. It will be energized or de-energized (non fail save or fail save respectively) depending on what mode of operation was selected. A time and date stamped trip record is also generated and saved in non volatile memory for later retrieval. Memory space for 60 trip records is allocated. The layout of the trip record is discussed in chapter 2 that deals with specifications.

Event records are also time and date stamped. It is more comprehensive and saved in non volatile memory. Only read access is given to the user. This information can be used for insurance claims and liability cases. The layout of the event record is discussed in chapter 2 (specifications).

Six fault indication light emitting diodes (red) are placed on the front panel. The green light emitting diode will come on only if the relay is in a healthy state. A healthy state signifies that the motor could be static or in operation within it's save operating parameters. The fault indications are displayed on the front panel as follows:

Name of Fault	Indication LED used	Display mode
Over current	Overload	Solid on
Short circuit	Overload	Solid on
Minimum load	Min Load	Solid on
Phase Rotation	Phase Rotation	Solid on
Unbalance Phase Currents	Unbalance	Solid on
Single Phasing	Unbalance	Solid on
Insulation Failure	Insulation failure	Solid on
Run-Stall	Overload	Solid on
Vectorial-Stall	Overload	Solid on
Earth leakage	Earth leakage	Solid on
Earth fault	Earth leakage	Solid on
Over voltage	Phase rotation	3 sec on, 1 sec off
Under voltage	Phase rotation	1 sec on, 3 sec off
Voltage symmetry	Phase rotation	1 sec on, 1 sec off
Starts per hour	Overload & Healthy	Both 1 sec on, 1 sec off
High frequency	Unbalance	3 sec on, 1 sec off
Low frequency	Unbalance	1 sec on, 3 sec off

The reset button is used to acknowledge and reset trip faults. A reset will only take affect if sufficient thermal capacity is regained during the cooling period and no phase current flows. If the reset button is pressed during the cooling cycle the Overload LED will start flashing (1 second on, 1 second off) to signify cooling. Once the required thermal capacity level is reached, the relay will reset.

The real time clock is running from a super capacitor which is continuously charged by the auxiliary power supply. The real time clock should be able to continue running for another 5 days in the event of auxiliary supply failure. The real time clock provides time and date for record keeping (fault and event records) and also participates in the control functions.

The protection unit (NewCode) is equipped with four electromechanical relays (Relay 1, 2, 3 and 4) and seven opto-isolated digital field inputs (Digital Field Inputs 1 to 7). When Relay 1 is configured as the main trip relay it has a dedicated protection function. Relay 2, 3 and 4 are general purpose relays. The relays are configurable and available to participate in any of the control functions. The control logic is realized with the aid of six logic function blocks. Each of these blocks has three configurable inputs. A configurable input can typically be connected to any one of seventy three different signals (see specifications).

Starter functions are added to the control logic and three types are available to choose from namely Direct On Line (DOL), Star-Delta and Forward / Reverse. Three different start control localities are also selectable namely local, remote and automatic (PLC control) to start the motor from. These start control sites are static or dynamically selectable.

The protection unit (NewCode) has an internal interchangeable communication module. Three different protocols are available and to choose from namely Modbus, Profibus and CANbus.

5. Installation Instructions

5.1 Front-end requirements

A Pentium personal computer or laptop is required to setup the NewCode MK-1 relay. The computer must be equipped with USB ports. The operating system software requirement is MS Windows 2000, MS Windows XP or later versions. The front-end software is free of charge but remains the property of NewElec Pretoria (Pty) Ltd. It is available from NewElec's website and also supplied with the purchase of new relays.

5.2 Setting up the relay

Once the wiring is being done and checked by qualified personnel, the relay is ready to be configured. The four most important front-end screens are the settings (diagram 6.4), control logic, starter and statistics screens. These four screens enable the user to adjust parameters, select protection features, determine control strategy, select a starter configuration and setup the communications network. The control and starter screens are linked together when settings are saved or retrieved from disk.

When setting changes were made it has to be transmitted to the relay to become effective. Changes on the control logic and starter screens can only be made when off line is selected. When on line is selected again, the settings are transmitted to the relay. Relays are shipped to the user with a set of default settings and may be appropriate in some cases.

To determine the full load current setting (MLC), the motor has to be started and allowed to run at full load capacity. Press the reset button and use the front-end settings screen to adjust the MLC till the overload indication just switches off. Release now the reset button. The front-end can be used to confirm that the load current level indicated is between 90% and 99%. (Hint: Use the calculator of the front-end to confirm the setting). The minimum load setting adjustment (motor run with no load) is done in a similar way with the aid if the reset button, minimum load setting.

The real time clock should be checked and adjusted to the correct time setting. The fault history can also be erased to start afresh.

5.3 Firmware upgrade instructions

The relay has a boot loader program on board. The function of the boot loader is to facilitate the down load of new firmware revisions via the frontend and the USB bus onto the relay. Newer firmware revisions will be come available when bug fixes were made and new functionality was added. When the user wants to upgrade the following steps must be followed to ensure success.

Step 1 - Ensure that a USB to mini-b USB cable is plugged into the NewCode relay.

Step 2 - Power up the relay (either 110V or 220V AC) as per Electrical wiring diagram.

Step 3 - Launch the NewCode boot loader software Ver 1A from the CD provided.

Step 4 - Select the correct Communication Port from the drop down list. Once selected click "OPEN PORT"

Step 5 - The "COMPORT OPENED" message will be displayed in the Session message box. Click on "SEARCH FOR DEVICE" Tab (Top Left RED Button). The 'UNBALANCE', 'OVERLOAD' and 'INSULATION FAILURE' LED's will light up.

Step 6 - "Looking for Device" will be displayed in the Session Message Box. "Device Found", will be displayed in the Session Message Box. "Version: xx.xx", will be displayed in the Session Message Box. "Product ID :x", will be displayed in the Session Message Box. The 'UNBALANCE', 'OVERLOAD' and 'INSULATION FAILURE' LED's will light up.

Step 7 - Click on "OPEN UPDATE FILE" (Second button from the left). Select the latest NewCode .enc file (example NC_ENC_1D-00.enc) Click on "OPEN". The 'UNBALANCE', 'OVERLOAD' and 'INSULATION FAILURE' LED's will light up.

Step 8 - The Bootloader will now check the integrity of the selected file. "Status: Busy Checking Open File xx%" will be displayed in the bottom left corner of the Bootloader. This should take approximately 45 seconds (PC dependant). The 'UNBALANCE', 'OVERLOAD' and 'INSULATION FAILURE' LED's will light up.

Step 9 - Once the file has been checked and no faults found, "File Loaded: 'File Location'" will be displayed in the Session Message Box. The "UPLOAD FILE TO RELAY" Button will now be active (Third button from the left) Click on "UPLOAD FILE TO RELAY' Button.

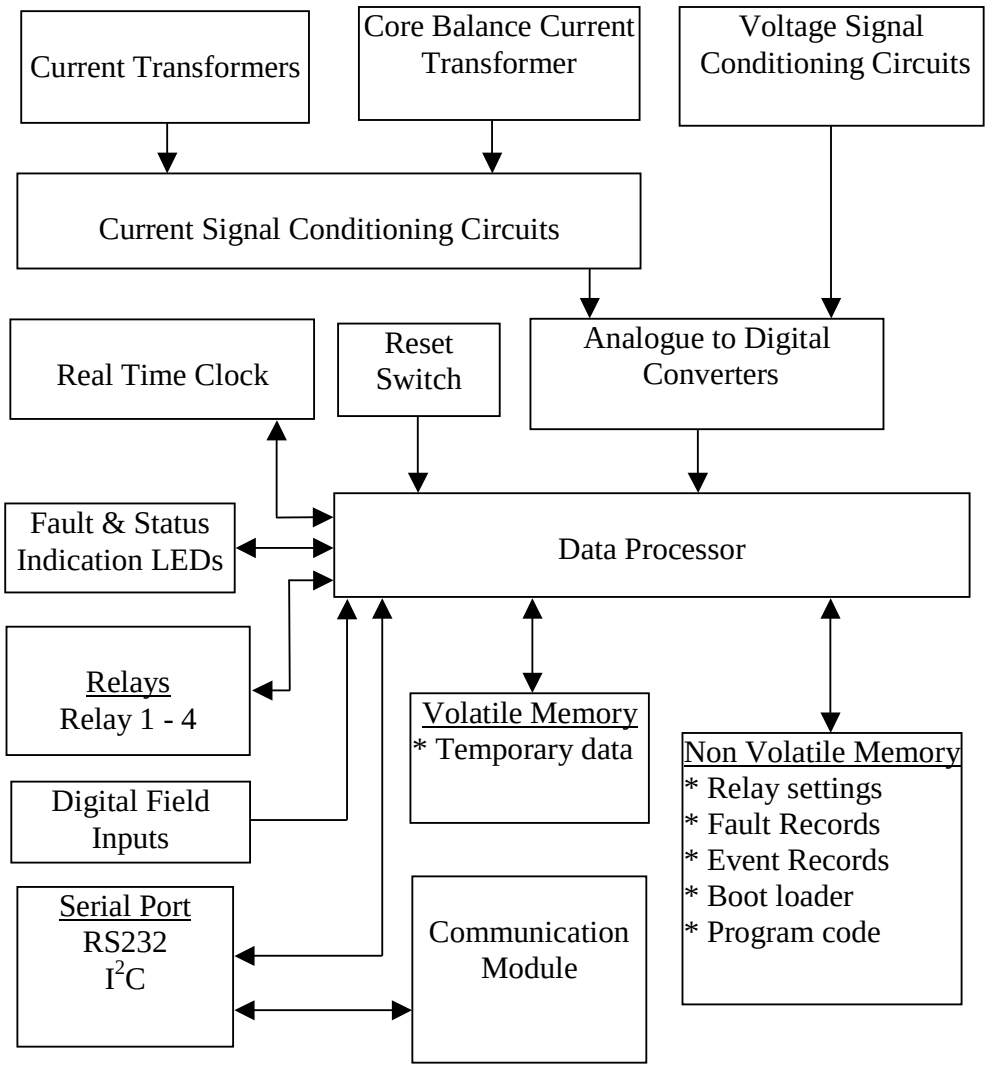
Step 10 - The Bootloader will erase the files currently stored in the Flash Memory on the relay and will automatically begin uploading the new firmware to the flash. This step may take approximately 5 minutes to complete. During the Erase Cycle, the 'UNBALANCE', 'OVERLOAD', 'PHASE ROTATION' and ' EARTH LEAKAGE' LED's will light up. During the Programme Cycle the 'MIN LOAD', 'PHASE ROTATION' and 'EARTH LEAKAGE' LED's will light up. During both cycles, the progress is displayed as a % in the bottom left of the Bootloader

Step 11 – Once the Programming is complete, the relay should automatically be returned to its normal mode and the GREEN LED indicating 'RELAY HEALTHY' will light up. The Bootloader can now be closed and the NewCode Frontend must be re-opened.

6. Diagrams

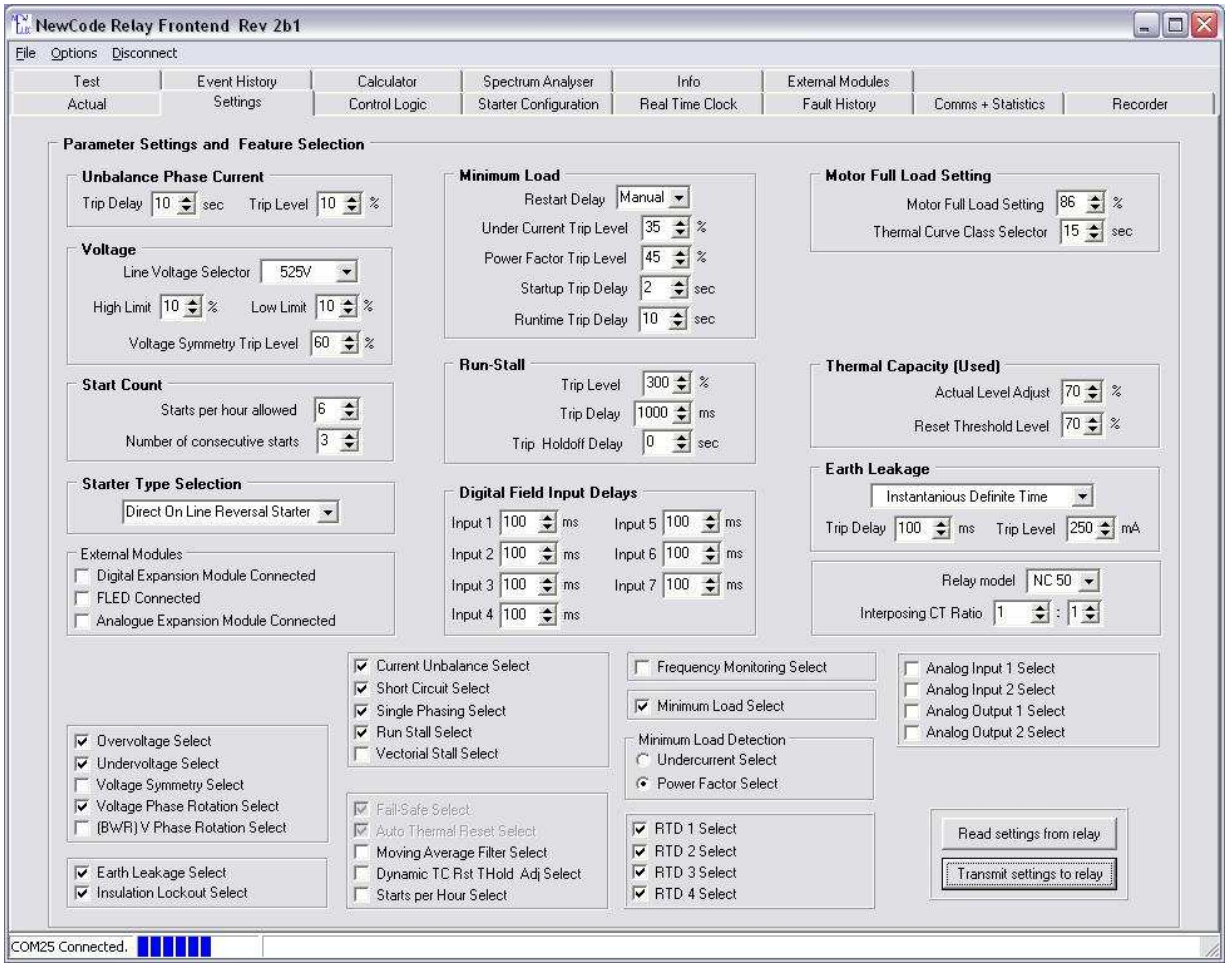
6.1 Picture of the Relay

6.2 Block Diagram of the Relay

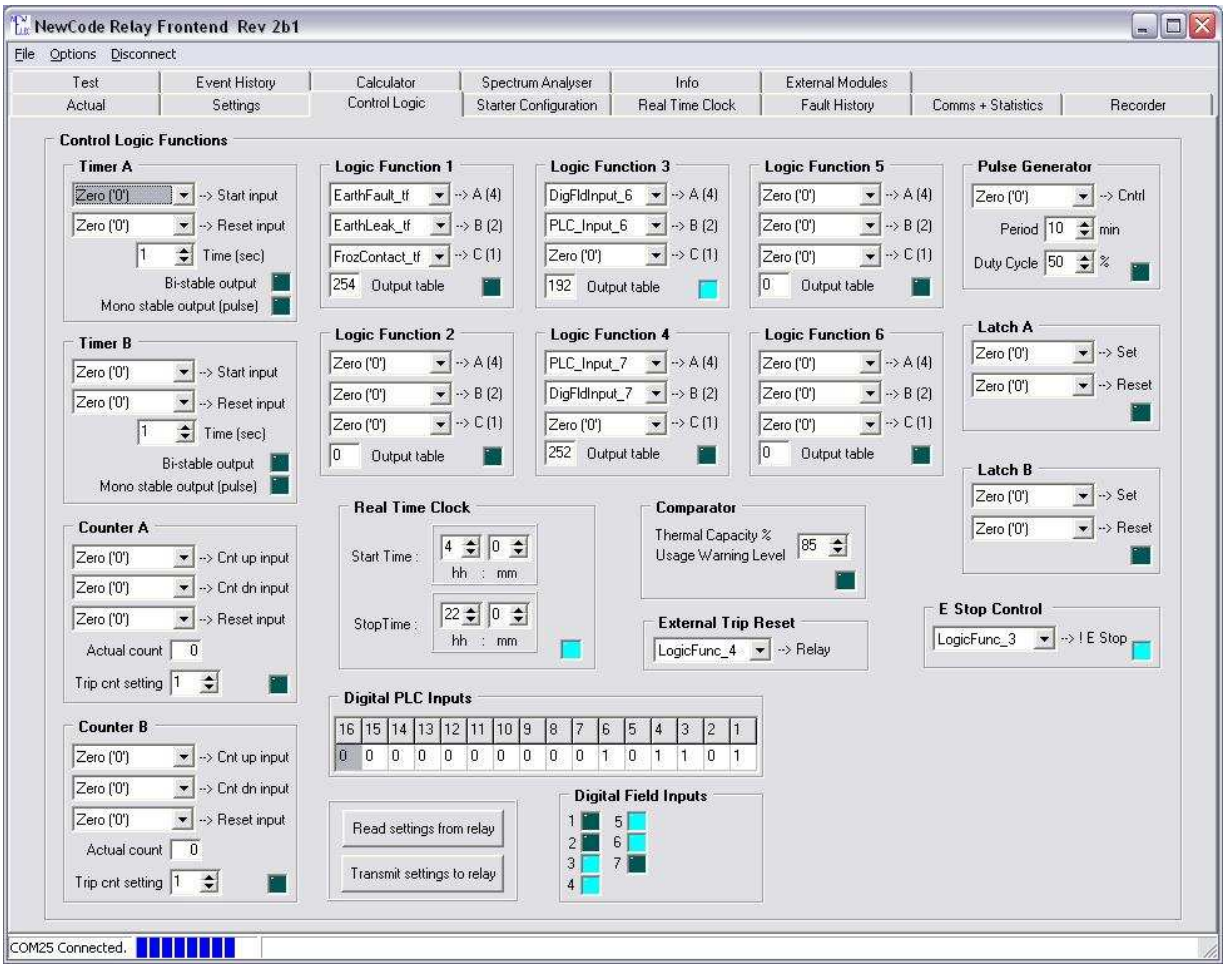


6.3 Front-End Setup Screens

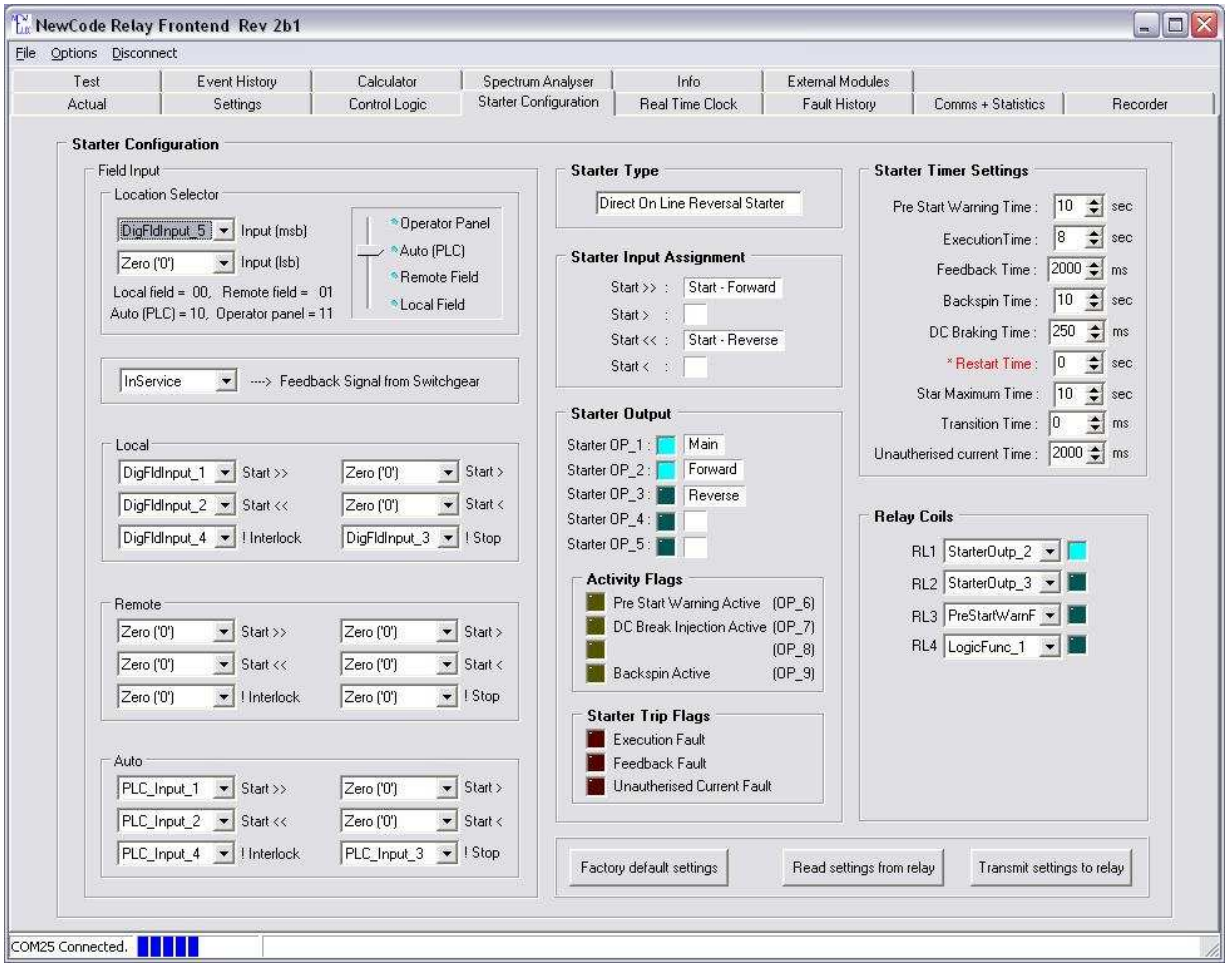
6.3.1 Settings screen


NewCode Relay Frontend Rev 2b1
File Options Disconnect
Test Event History Calculator Spectrum Analyser Info External Modules
Actual Settings Control Logic Starter Configuration Real Time Clock Fault History Comms + Statistics Recorder
Parameter Settings and Feature Selection
Unbalance Phase Current
Trip Delay 10 sec Trip Level 10 %
Voltage
Line Voltage Selector 525V
High Limit 10 % Low Limit 10 %
Voltage Symmetry Trip Level 60 %
Start Count
Starts per hour allowed 6
Number of consecutive starts 3
Starter Type Selection
Direct On Line Reversal Starter
External Modules
Digital Expansion Module Connected
FLED Connected
Analogue Expansion Module Connected
Minimum Load
Restart Delay Manual
Under Current Trip Level 35 %
Power Factor Trip Level 45 %
Startup Trip Delay 2 sec
Runtime Trip Delay 10 sec
Run-Stall
Trip Level 300 %
Trip Delay 1000 ms
Trip Holdoff Delay 0 sec
Digital Field Input Delays
Input 1 100 ms Input 5 100 ms
Input 2 100 ms Input 6 100 ms
Input 3 100 ms Input 7 100 ms
Input 4 100 ms
Motor Full Load Setting
Motor Full Load Setting 86 %
Thermal Curve Class Selector 15 sec
Thermal Capacity (Used)
Actual Level Adjust 70 %
Reset Threshold Level 70 %
Earth Leakage
Instantanious Definite Time
Trip Delay 100 ms Trip Level 250 mA
Relay model NC 50
Interposing CT Ratio 1 : 1
Overvoltage Select
Undervoltage Select
Voltage Symmetry Select
Voltage Phase Rotation Select
(BWR) V Phase Rotation Select
Earth Leakage Select
Insulation Lockout Select
Current Unbalance Select
Short Circuit Select
Single Phasing Select
Run Stall Select
Vectorial Stall Select
Fail-Safe Select
Auto Thermal Reset Select
Moving Average Filter Select
Dynamic TC Rst THold Adj Select
Starts per Hour Select
Frequency Monitoring Select
Minimum Load Select
Minimum Load Detection
Undercurrent Select
Power Factor Select
RTD 1 Select
RTD 2 Select
RTD 3 Select
RTD 4 Select
Analog Input 1 Select
Analog Input 2 Select
Analog Output 1 Select
Analog Output 2 Select
Read settings from relay
Transmit settings to relay
COM25 Connected.

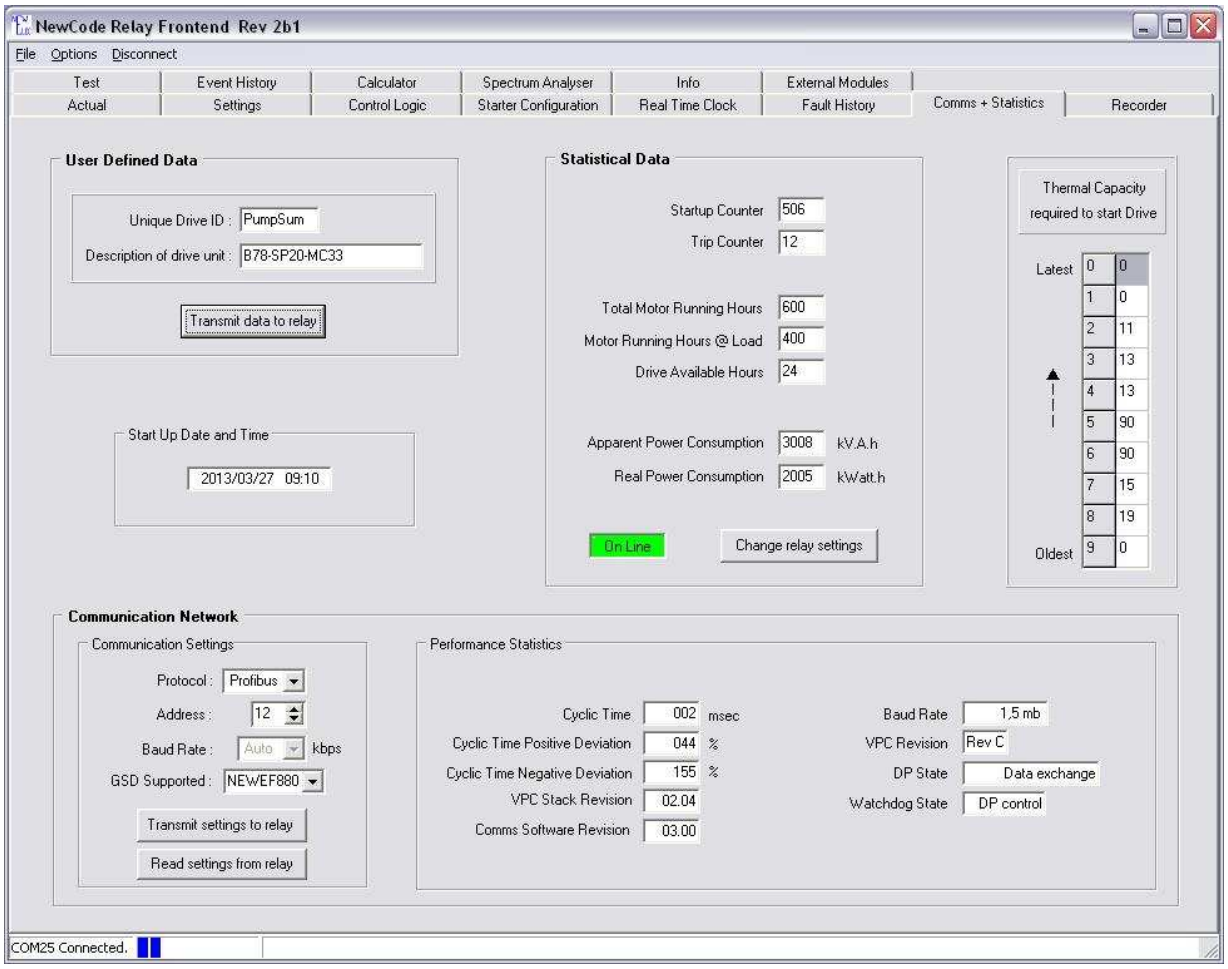
6.3.2 Control Logic Screen



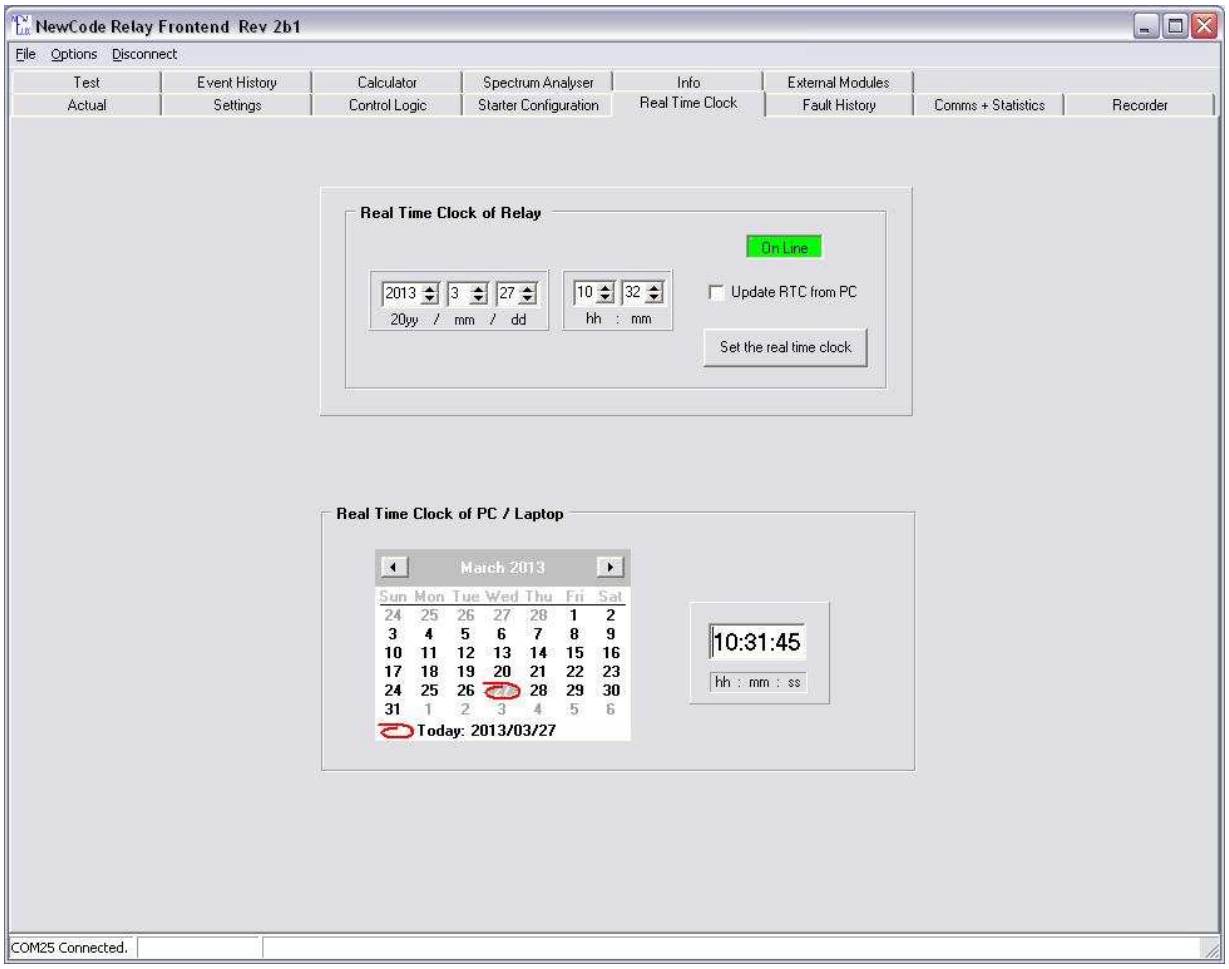
6.3.3 Starter Logic Screen



6.3.3 Statistics Screen

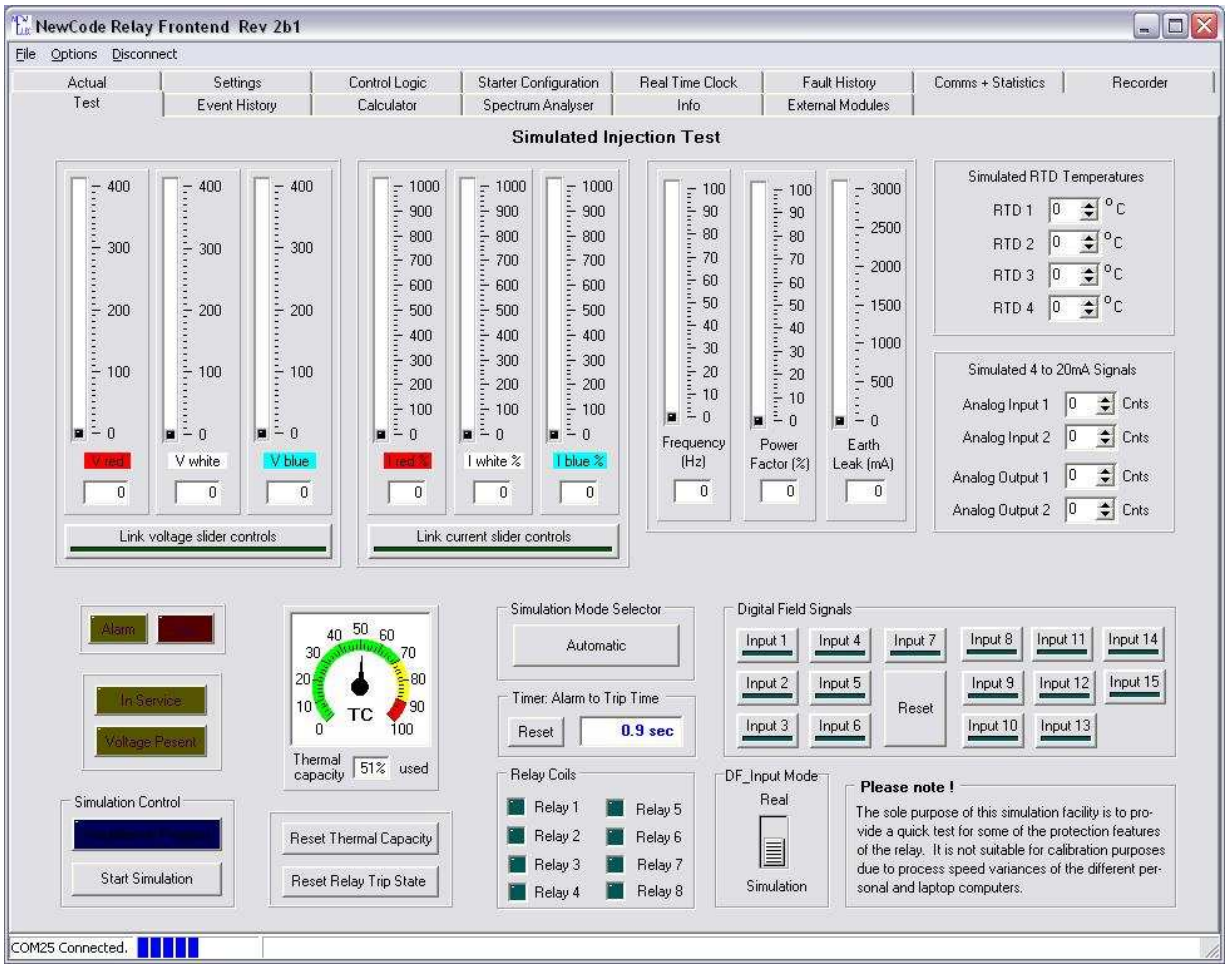


6.3.5 Real Time Clock Screen

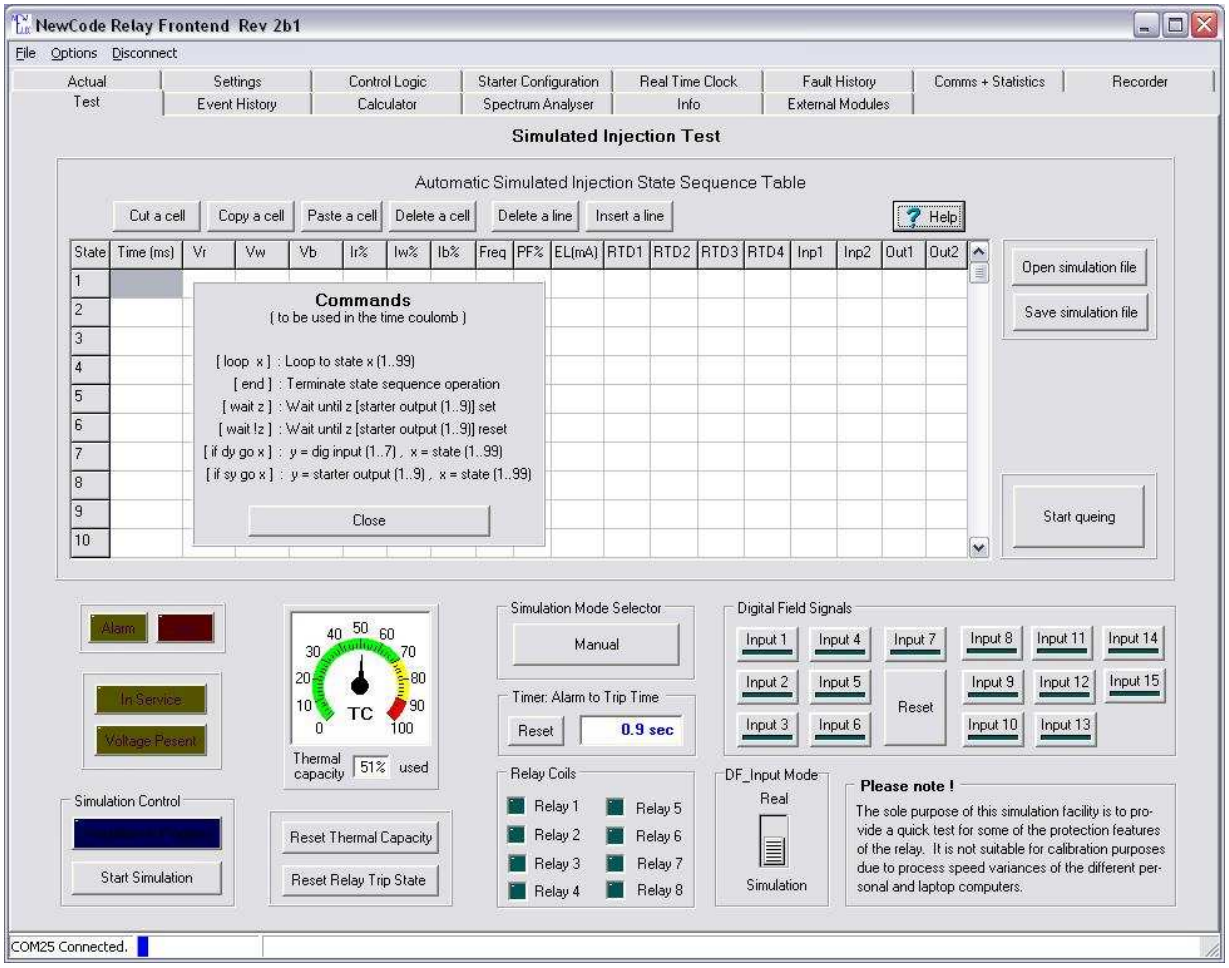


6.4 Front-End Assistance Screens

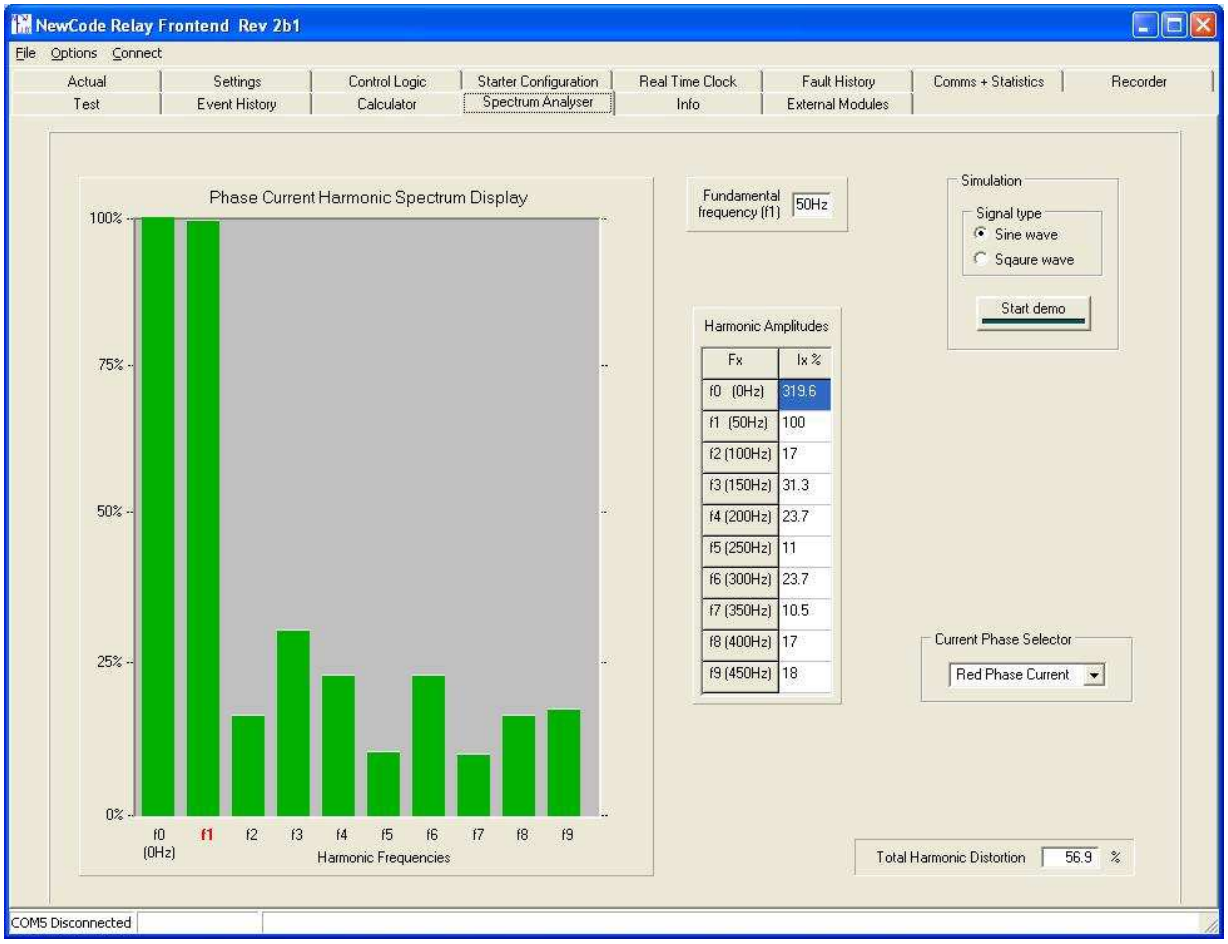
6.4.1 Test Screen (Manual)



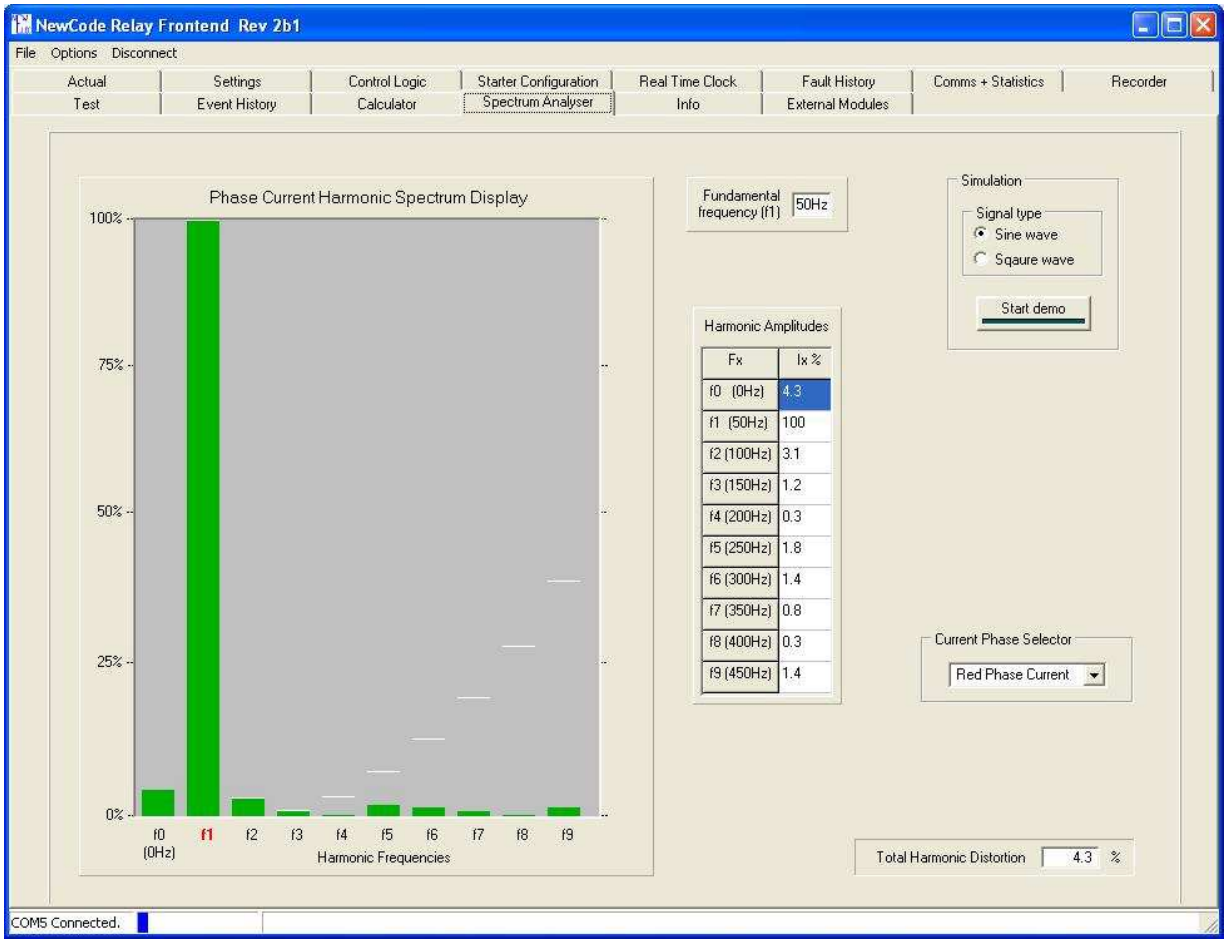
6.4.2 Test Screen (Automatic)


NewCode Relay Frontend Rev 2b1
File Options Disconnect
Actual Settings Control Logic Starter Configuration Real Time Clock Fault History Comms + Statistics Recorder
Test Event History Calculator Spectrum Analyser Info External Modules
Simulated Injection Test
Automatic Simulated Injection State Sequence Table
Cut a cell Copy a cell Paste a cell Delete a cell Delete a line Insert a line Help
State Time (ms) Vr Vw Vb Ir% Iw% Ib% Freq PF% EL(mA) RTD1 RTD2 RTD3 RTD4 Inp1 Inp2 Out1 Out2
Commands
(to be used in the time coulomb)
[loop x] : Loop to state x (1..99)
[end] : Terminate state sequence operation
[wait z] : Wait until z [starter output (1..9)] set
[wait !z] : Wait until z [starter output (1..9)] reset
[if dy go x] : y = dig input (1..7) , x = state (1..99)
[if sy go x] : y = starter output (1..9) , x = state (1..99)
Close
Open simulation file
Save simulation file
Start queing
Alarm
In Service
Voltage Present
TC
Thermal capacity 51% used
Simulation Mode Selector
Manual
Timer: Alarm to Trip Time
Reset
0.9 sec
Digital Field Signals
Input 1 Input 2 Input 3 Input 4 Input 5 Input 6 Input 7 Reset Input 8 Input 9 Input 10 Input 11 Input 12 Input 13 Input 14 Input 15
Relay Coils
Relay 1 Relay 2 Relay 3 Relay 4 Relay 5 Relay 6 Relay 7 Relay 8
DF_Input Mode
Real
Simulation
Please note !
The sole purpose of this simulation facility is to provide a quick test for some of the protection features of the relay. It is not suitable for calibration purposes due to process speed variances of the different personal and laptop computers.
Simulation Control
Start Simulation
Reset Thermal Capacity
Reset Relay Trip State
COM25 Connected.

6.4.3 Spectrum Analyzer Screen (1)

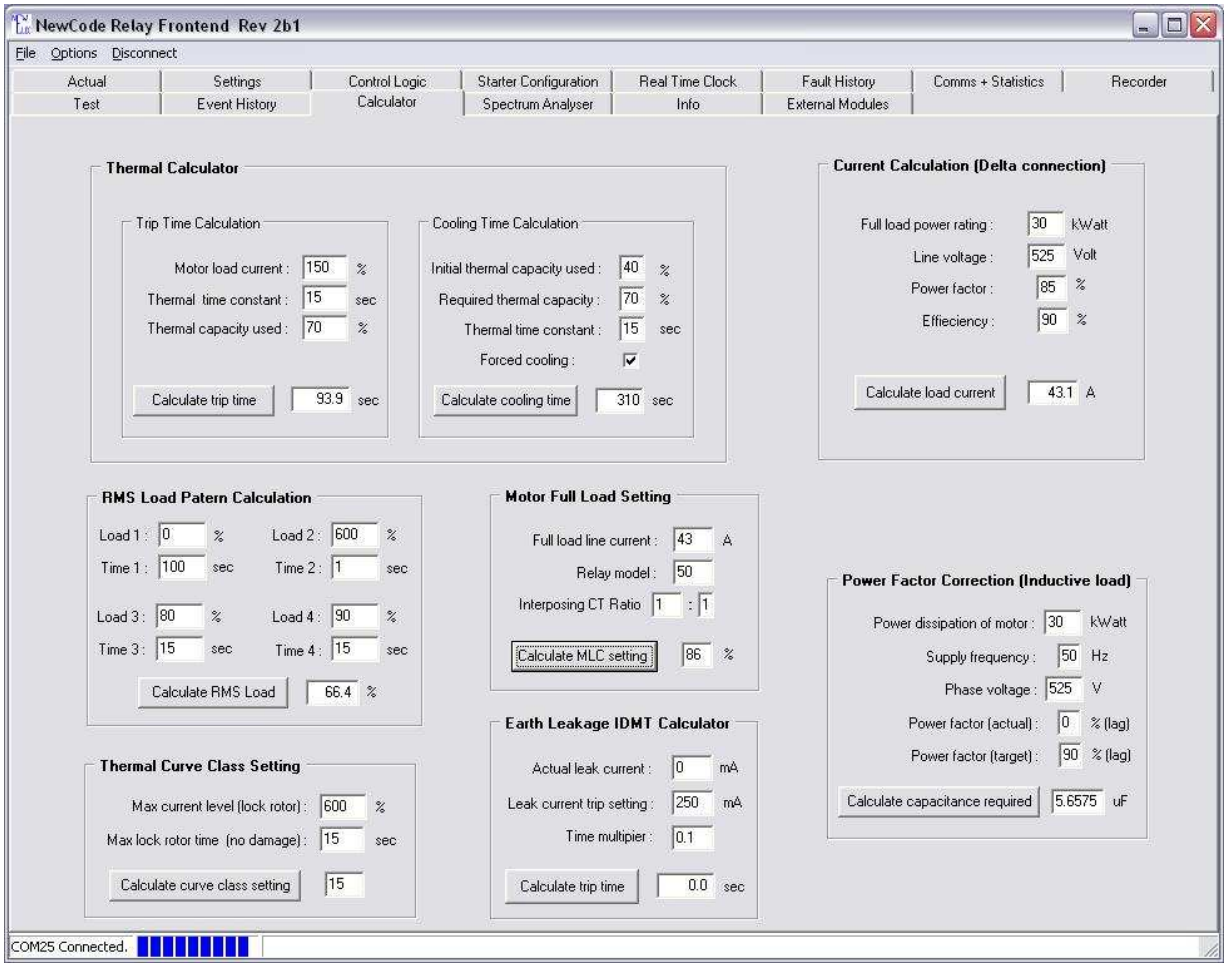


6.4.4 Spectrum Analyser Screen (2)

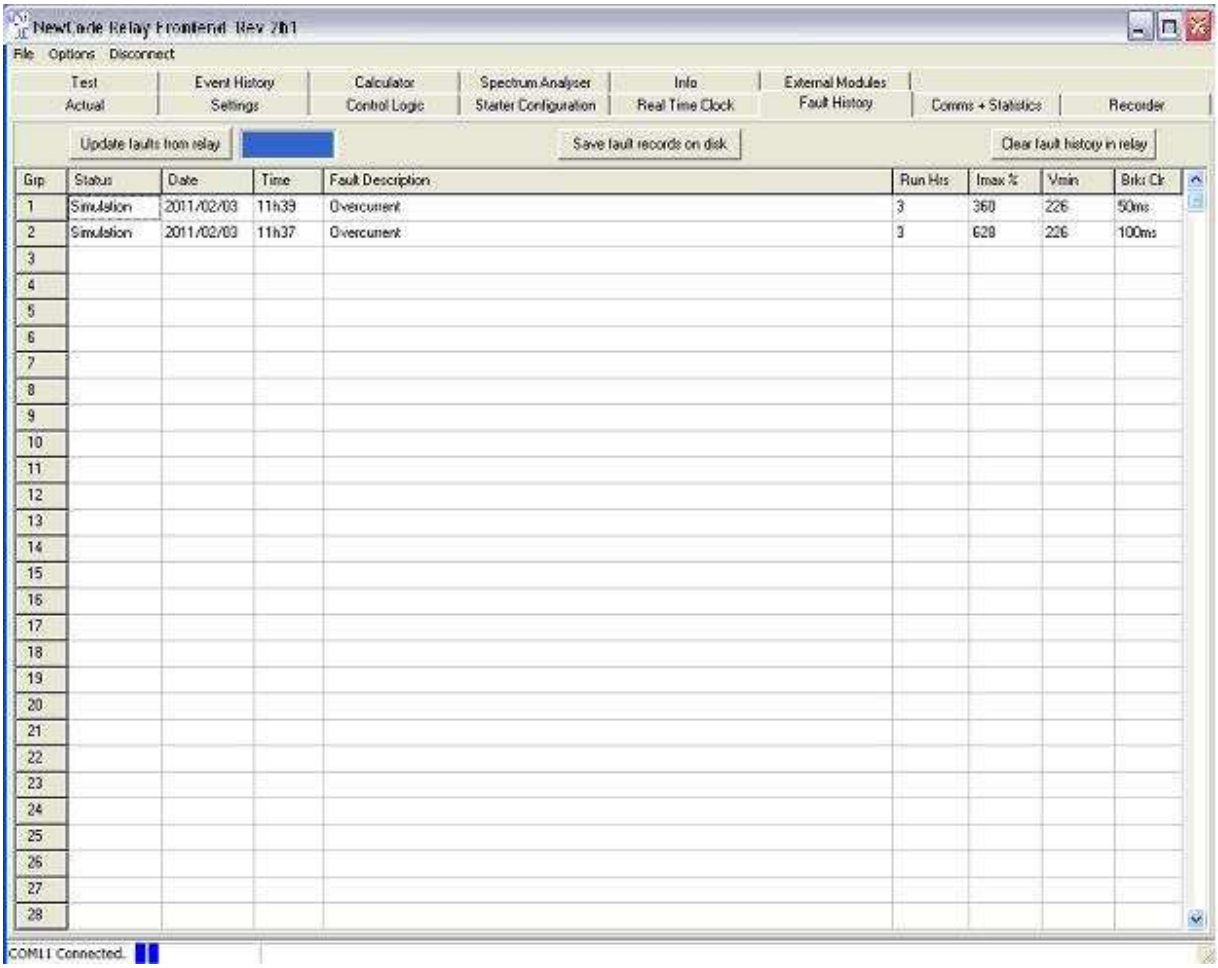


6.4.5 Actual Screen

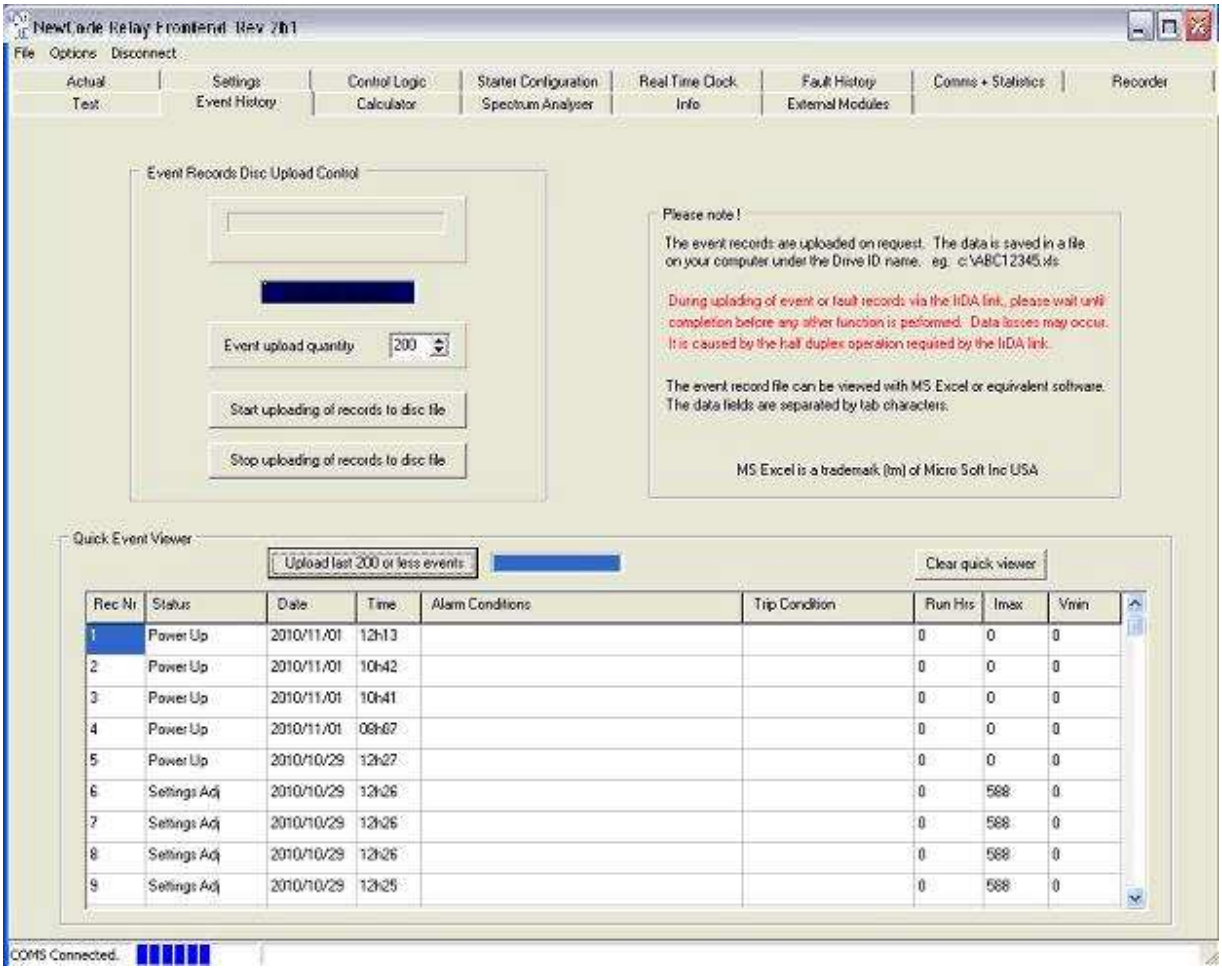
6.4.6 Calculator Screen


NewCode Relay Frontend Rev 2b1
File Options Disconnect
Actual Settings Control Logic Starter Configuration Real Time Clock Fault History Comms + Statistics Recorder
Test Event History Calculator Spectrum Analyser Info External Modules
Thermal Calculator
Trip Time Calculation
Motor load current : 150 %
Thermal time constant : 15 sec
Thermal capacity used : 70 %
Calculate trip time 93.9 sec
Cooling Time Calculation
Initial thermal capacity used : 40 %
Required thermal capacity : 70 %
Thermal time constant : 15 sec
Forced cooling :
Calculate cooling time 310 sec
Current Calculation (Delta connection)
Full load power rating : 30 kWatt
Line voltage : 525 Volt
Power factor : 85 %
Effieciency : 90 %
Calculate load current 43.1 A
RMS Load Patern Calculation
Load 1 : 0 % Load 2 : 600 %
Time 1 : 100 sec Time 2 : 1 sec
Load 3 : 80 % Load 4 : 90 %
Time 3 : 15 sec Time 4 : 15 sec
Calculate RMS Load 66.4 %
Motor Full Load Setting
Full load line current : 43 A
Relay model : 50
Interposing CT Ratio 1 : 1
Calculate MLC setting 86 %
Power Factor Correction (Inductive load)
Power dissipation of motor : 30 kWatt
Supply frequency : 50 Hz
Phase voltage : 525 V
Power factor (actual) : 0 % (lag)
Power factor (target) : 90 % (lag)
Calculate capacitance required 5.6575 uF
Thermal Curve Class Setting
Max current level (lock rotor) : 600 %
Max lock rotor time (no damage) : 15 sec
Calculate curve class setting 15
Earth Leakage IDMT Calculator
Actual leak current : 0 mA
Leak current trip setting : 250 mA
Time multipier : 0.1
Calculate trip time 0.0 sec
COM25 Connected.

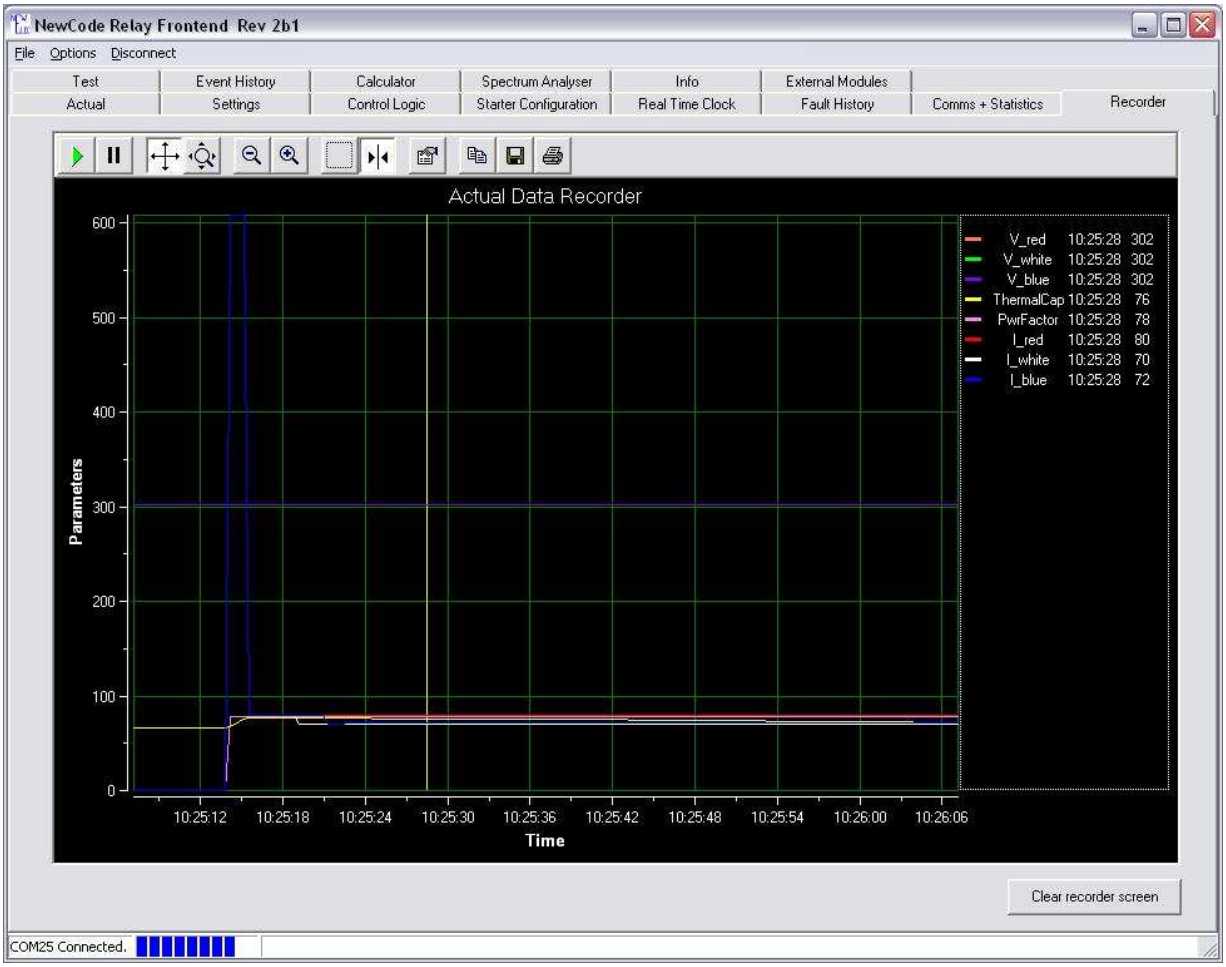
6.4.7 Fault Screen


NewCode Relay Frontend Rev 2b1
File Options Disconnect
Test Actual
Event History Settings
Calculator Control Logic
Spectrum Analyser Starter Configuration
Info Real Time Clock
External Modules Fault History
Comms + Statistics
Recorder
Update faults from relay
Save fault records on disk
Clear fault history in relay
Grp Status Date Time Fault Description Run Hrs Imax % Vmin Brkr Clr
1 Simulation 2011/02/03 11h39 Overcurrent 3 360 226 50ms
2 Simulation 2011/02/03 11h37 Overcurrent 3 628 226 100ms
COM11 Connected.

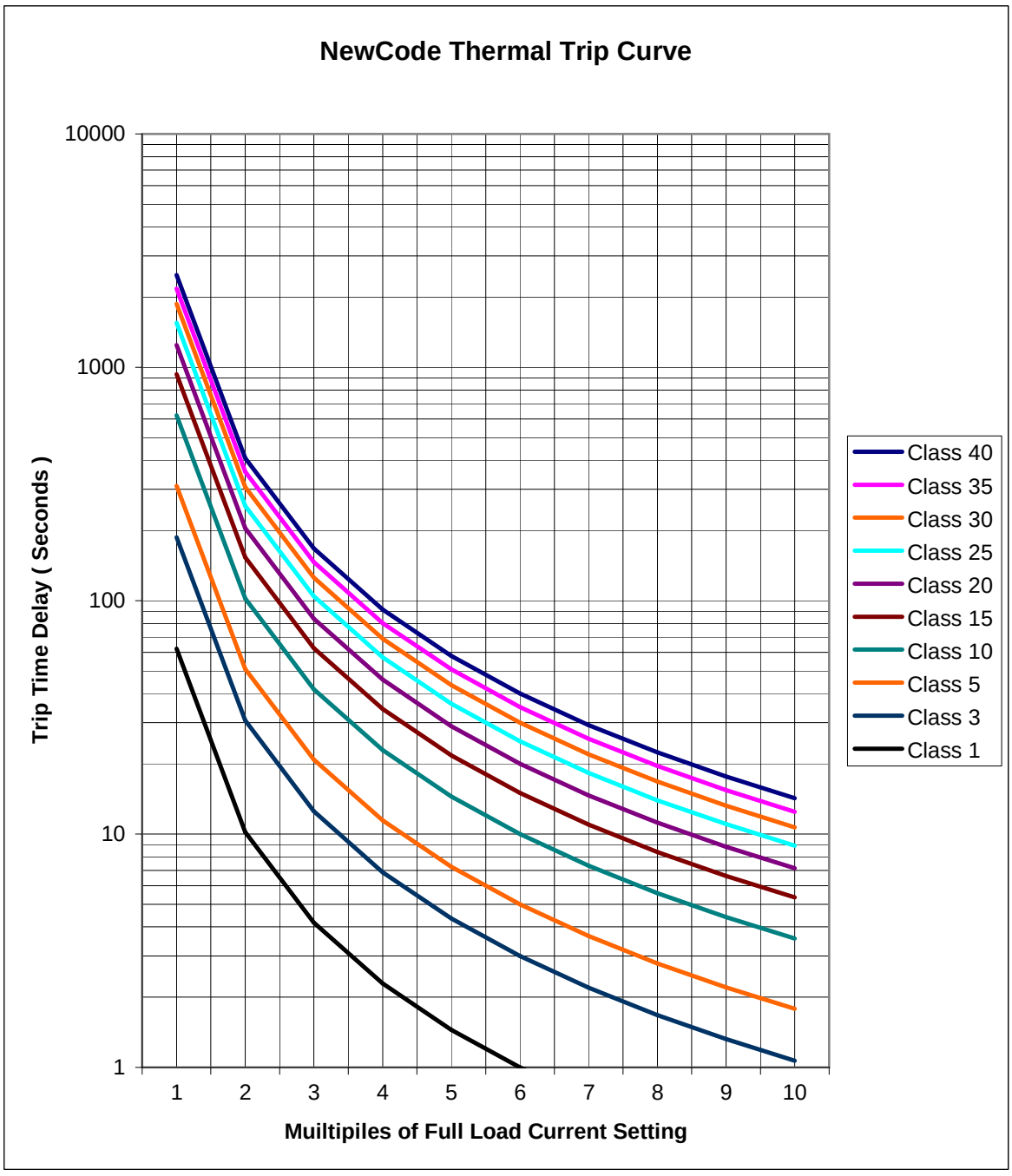
6.4.8 Events Screen


NewCode Relay Frontend Rev 2b1
File Options Disconnect
Actual Settings Control Logic Starter Configuration Real Time Clock Fault History Comms + Statistics Recorder
Test Event History Calculator Spectrum Analyser Info External Modules
Event Records Disc Upload Control
Event upload quantity 200
Start uploading of records to disc file
Stop uploading of records to disc file
Please note !
The event records are uploaded on request. The data is saved in a file on your computer under the Drive ID name. eg. c:\ABC12345.xls
During uploading of event or fault records via the IrDA link, please wait until completion before any other function is performed. Data losses may occur. It is caused by the half duplex operation required by the IrDA link.
The event record file can be viewed with MS Excel or equivalent software. The data fields are separated by tab characters.
MS Excel is a trademark (tm) of Micro Soft Inc USA
Quick Event Viewer
Upload last 200 or less events
Clear quick viewer
Rec Nr Status Date Time Alarm Conditions Trip Condition Run Hrs Imax Vmin
1 Power Up 2010/11/01 12h13 0 0 0
2 Power Up 2010/11/01 10h42 0 0 0
3 Power Up 2010/11/01 10h41 0 0 0
4 Power Up 2010/11/01 09h07 0 0 0
5 Power Up 2010/10/29 12h27 0 0 0
6 Settings Adj 2010/10/29 12h26 0 588 0
7 Settings Adj 2010/10/29 12h26 0 588 0
8 Settings Adj 2010/10/29 12h26 0 588 0
9 Settings Adj 2010/10/29 12h25 0 588 0
COMS Connected.

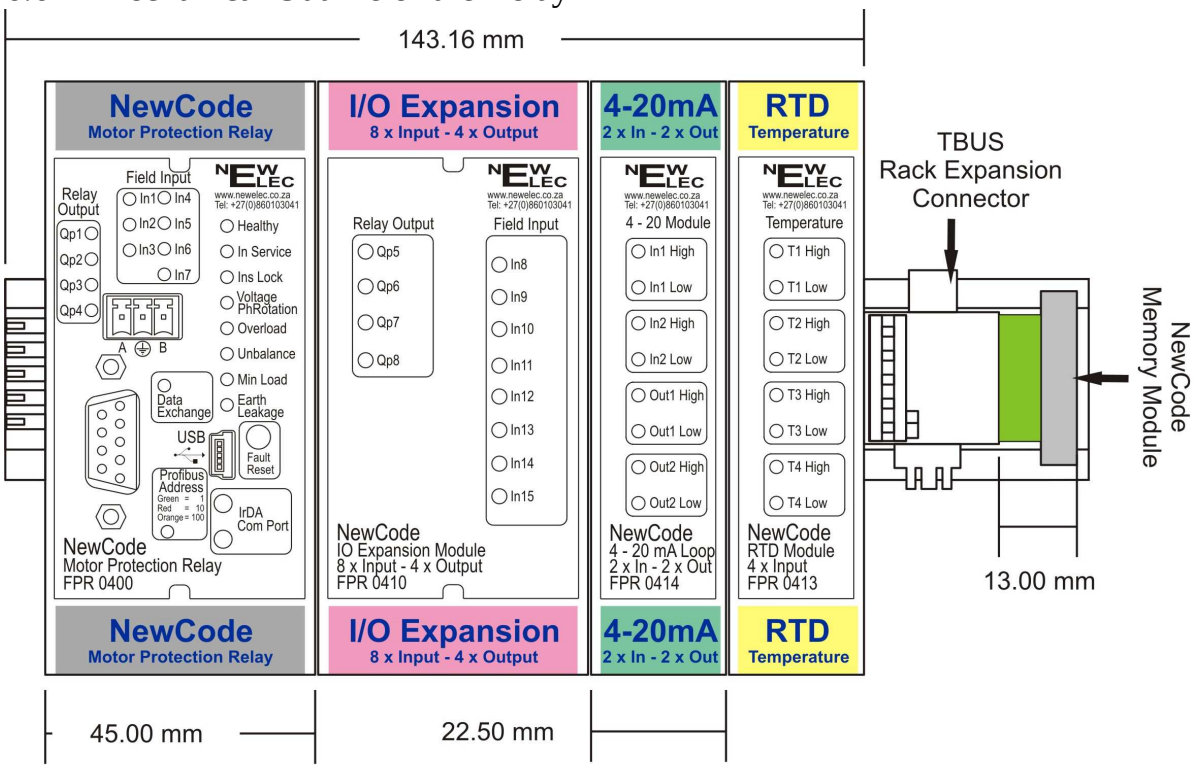
6.4.9 Recorder Screen

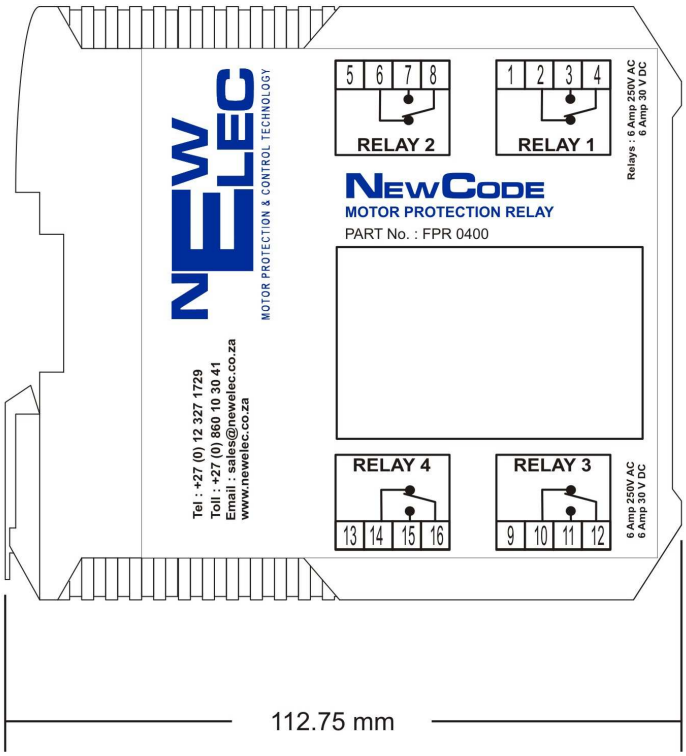


6.5 Thermal Curves of the NewCode Relay

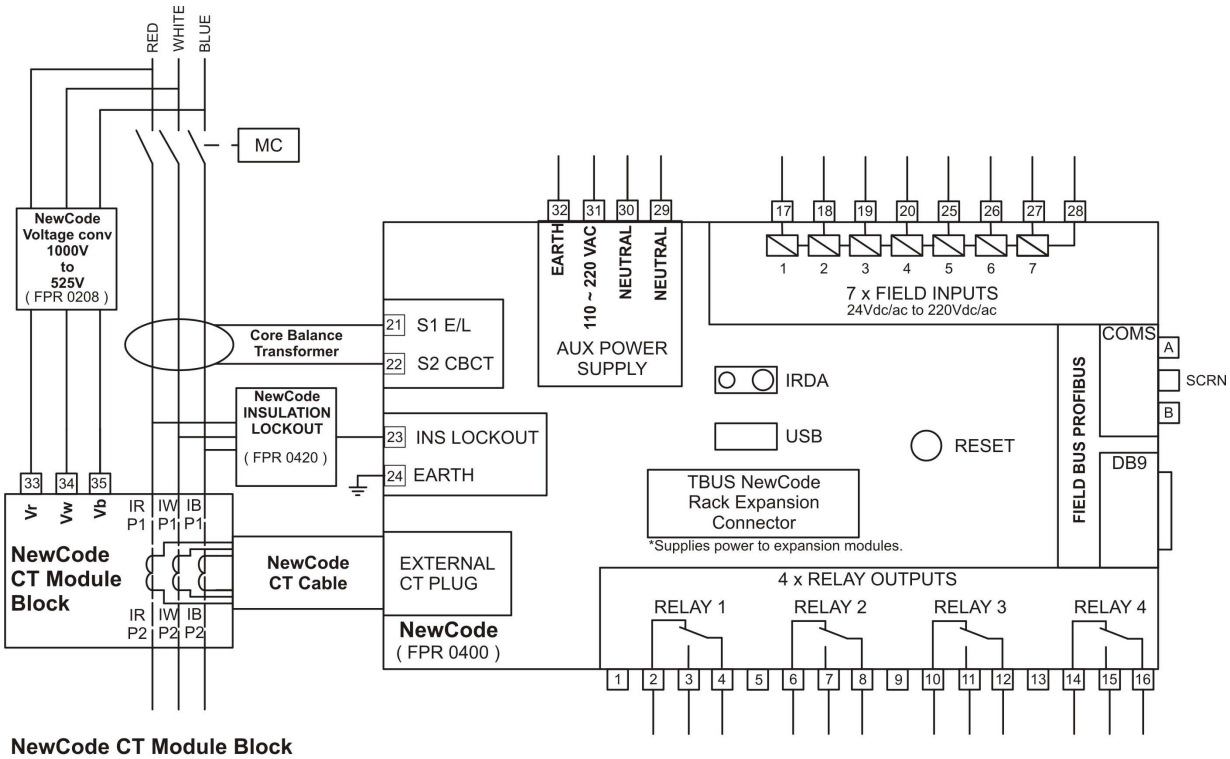


6.6 Mechanical Outline of the Relay





6.7 Electrical diagram of the Relay.



NewCode CT Module Block

NC-300-CBCT [30 to 300 Amps / 550 Vac / EL CBCT] (FPR 0401)
NC-100-CBCT [10 to 100 Amps / 550 Vac / EL CBCT] (FPR 0402)
NC-001-CBCT [0.1 to 1 Amps / 550 Vac] (FPR 0403)
NC-005-CBCT [0.5 to 5 Amps / 550 Vac] (FPR 0404)
NC-025-CBCT [2.5 to 25 Amps / 550 Vac] (FPR 0405)
NC-050-CBCT [5 to 50 Amps / 550 Vac] (FPR 0406)

NewCode CT Cable

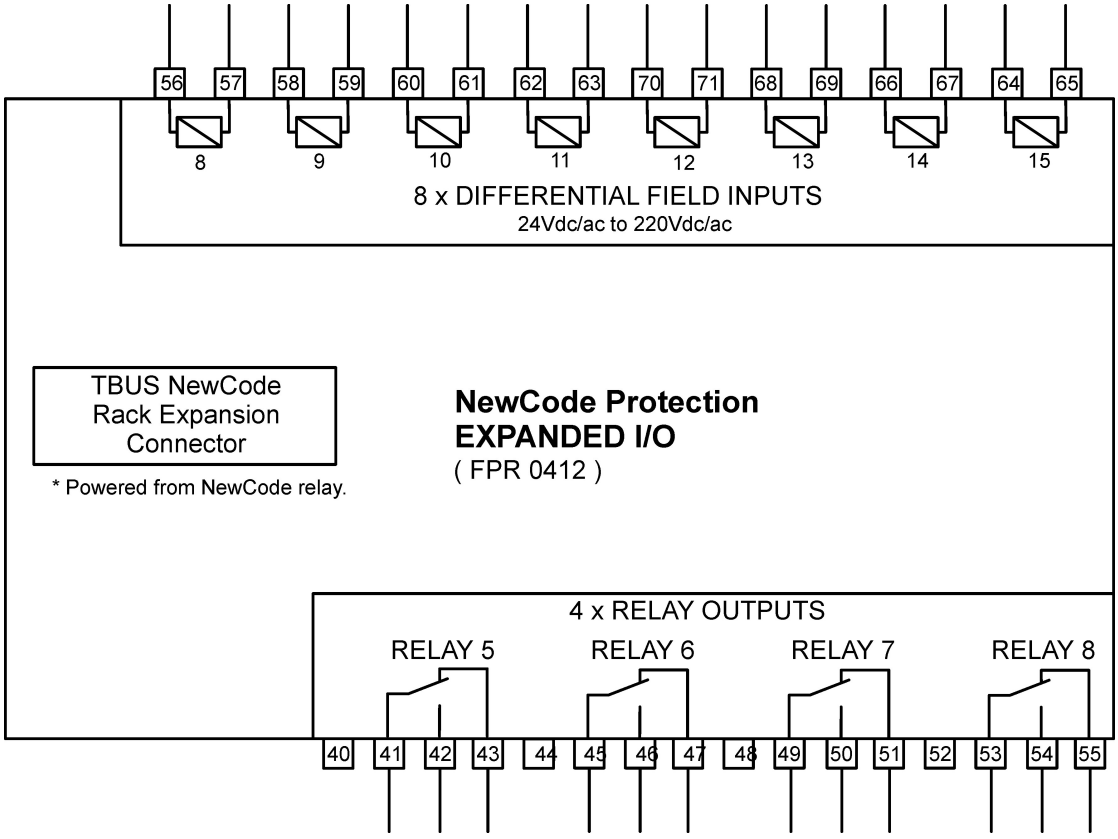
NC-CT-CAB-1000-1m (FPR 0408)
NC-CT-CAB-1000-500mm (FPR 0409)
NC-CT-CAB-1000-300mm (FPR 0410)
NC-CT-CAB-1000-100mm (FPR 0411)

Core Balance Transformer

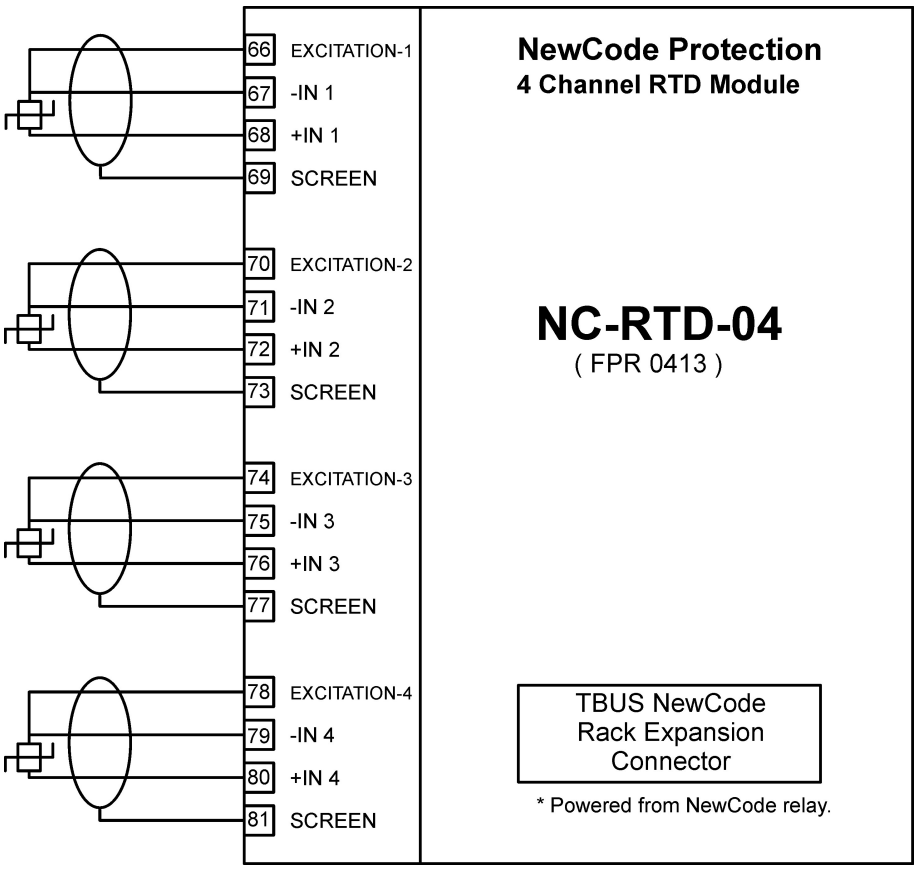
100mm Inside Diameter (BTX 0010)

NewCode Backup Memory Module
(FPR 0407)
Backup for NewCode relay settings and control logic configuration.
TBUS NewCode Rack Expansion Connector
* Powered from NewCode relay.

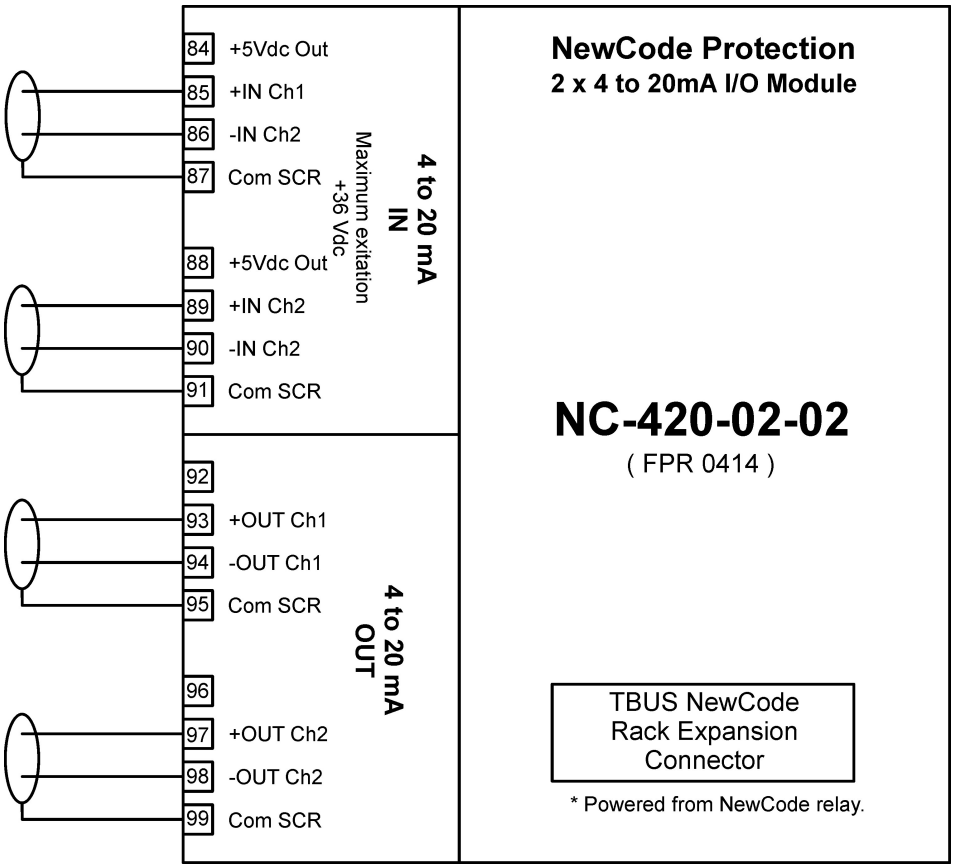
6.8 Expanded IO module wiring diagram of the Relay.


56 57 58 59 60 61 62 63 70 71 68 69 66 67 64 65
8 9 10 11 12 13 14 15
8 x DIFFERENTIAL FIELD INPUTS
24Vdc/ac to 220Vdc/ac
TBUS NewCode
Rack Expansion
Connector
* Powered from NewCode relay.
NewCode Protection
EXPANDED I/O
(FPR 0412)
4 x RELAY OUTPUTS
RELAY 5
RELAY 6
RELAY 7
RELAY 8
40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55

6.9 RTD Module Wiring Diagram



6.10 4 to 20mA Module Wiring Diagram



7. Accessories

NewElec NewCode Ordering Information		
Description.	**Part No**	**Bin No.**
110 – 230V NewCode Motor Protection Relay	FPR0416	65660
NewCode Motor Protection Relay with Profibus	FPR0400	65661
NewCode Motor Protection Relay with DeviceNet	FPR0417	65662
NewCode Motor Protection Relay with Modbus	FPR0418	65663
NewCode Motor Protection Relay with Canbus	FPR0419	65664
30 - 300 Amp C.T. & Core Balance with 110 – 550V Converter	FPR0401	65670
10 – 100 Amp C.T. & Core Balance with 110 – 550V Converter	FPR0402	65671
0.1 – 1 Amp C.T. Block with 110 – 550V Converter	FPR0403	65675
0.5 – 5 Amp C.T. Block with 110 – 550V Converter	FPR0404	65676
0.25 – 25 Amp C.T. Block with 110 – 550V Converter	FPR0405	65677
5 – 50 Amp C.T. Block with 110 – 550V Converter	FPR0406	65678
Core Balance - 100mm Dia. Window	BTX0010	65679
Connection Cable – 1000mm – C.T. to Relay	FPR0408	65685
Connection Cable – 500mm – C.T. to Relay	FPR0409	65686
Connection Cable – 300mm – C.T. to Relay	FPR0410	65687
Connection Cable – 100mm – C.T. to Relay	FPR0411	65688
External Memory Module	FPR0407	65695
NewCode Expanded I/O Module – 8 In/4 Out	FPR0412	65696
RTD Expansion Module	FPR0413	65697
NewCode Insulation Lockout Module	FPR0420	65698
NC-MK1-420-02-02 2X40-20 mA Input/Output	FPR0414	

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